



# The Pennsylvania **Green** Jobs Report

Part 1  
January 2010

*Prepared by the Pennsylvania Department of Labor & Industry*

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# The Pennsylvania Green Jobs Report | Executive Summary

- State and federal policies are driving investment in Pennsylvania's green sectors. Between 2010 and 2012, \$10 billion in public and private investment in the green economy will be a catalyst for generating 115,000 jobs.
- Pennsylvania is among the states with the highest number of green jobs. Advanced workforce policies and wise investments have made the state a national leader in creating and fostering a green economy.

Pennsylvania defines **green** jobs as:

Jobs that employ workers in producing or offering products or services that:

- promote energy efficiency;
- contribute to the sustainable use of resources;
- prevent pollution;
- clean up the environment; and
- promote the reduction of harmful emissions.

- Pennsylvania's green jobs are located, primarily, in five industry sectors:
  - Energy Efficiency (Sample employers: civil engineering consultants and building construction contractors)
  - Renewable Energy (Sample employers: wind turbine builders and electric utility companies)
  - Clean Transportation (Sample employers: aircraft manufacturers and transportation management companies)
  - Pollution Prevention & Environmental Cleanup (Sample employers: scientific research facilities and water treatment builders)
  - Agriculture & Resource Conservation (Sample employers: corn farms and energy consulting companies)
- Green jobs fall into three categories:
  - Emerging: including occupations such as energy auditors of buildings and other systems, wind technicians working with wind turbines, geothermal installers, solar panel installers
  - Evolving: including occupations such as construction workers skilled in commercial building, who are mastering new skills, allowing them to become expert conservation retrofitters
  - Traditional: including occupations such as construction laborers working on green building job sites, machinists making parts for wind turbines, refuse & recyclable materials collectors

- Pennsylvania identified 81 jobs most closely linked to green services or processes.
  - Many of the state's green occupations are mid-range technical jobs requiring some education beyond high school and/or a technical credential.
  - Green occupations generally pay well, are projected to grow and many are already targeted for workforce investments.
  - Targeted workforce training in emerging green occupations, such as energy auditors, solar panel installers, water treatment plant operators and weatherization installers & technicians, is a good investment from both a job seeker and employer perspective – a dual focus that Pennsylvania adopted in 2003 with *Job Ready Pennsylvania*.
  
- Future parts of *The Pennsylvania Green Jobs Report* will include:
  - An inventory of green education and training capacity
  - Additional information about careers in Pennsylvania's green industry sectors
  - Job task analyses of emerging and evolving green occupations

# The Pennsylvania Green Jobs Report | Section 1

## | Green Jobs, a Stronger Economy and a Cleaner Planet

In 2007, the Pew Charitable Trusts ranked Pennsylvania third among the states with the highest number of clean energy jobs.<sup>1</sup> While a fine achievement, Pennsylvania is just beginning to actualize the state's green jobs potential.

To this end, Pennsylvania is investing in industries and technologies that will create new jobs and transform old ones. We are improving access to education and training in emerging industries and occupations for our workforce, and we are cultivating partnerships among employers in industries with green potential. By doing so, Pennsylvania is making progress toward accomplishing our three-fold goal of more green jobs, a stronger economy and a healthier planet.

The *Pennsylvania Green Jobs Report* is part of the process. It looks at how we identify green jobs, how we categorize them and it delivers some projections of where employment in these careers – and the industries of which they're part – is headed. This report also examines how government – state and federal – is working with the private sector to make good policy and wise investments to help speed economic recovery and position Pennsylvania as the green economic leader it should be.

To start, we must clarify what is meant by the “green economy.” For the purposes of this and future reports, the Department of Labor & Industry, in consultation with environmental experts, defines green jobs as those that promote energy efficiency, contribute to the sustainable use of resources, prevent pollution and reduce harmful emissions or clean up the environment.

Within this broad definition of green jobs, there are three specific types of occupations. Emerging occupations, such as energy auditors, require new skills unique to green industries, and are projected to grow in the near- and long-term future. Evolving occupations, such as electricians and architects, will require workers to learn new skills to master green processes and meet industry demand. And, there are traditional occupations, such as construction laborers working on green building job sites and machinists making parts for wind turbines, that will be affected as green industry grows in Pennsylvania.

To analyze the green economy, the Pennsylvania Department of Labor & Industry's Center for Workforce Information & Analysis has identified five green industry sectors. They are:

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<sup>1</sup>The Pew Charitable Trusts. *The Clean Energy Economy: Repowering Jobs, Businesses and Investments Across America*. [http://www.pewcenteronthestates.org/uploadedFiles/Clean\\_Economy\\_Report\\_Web.pdf](http://www.pewcenteronthestates.org/uploadedFiles/Clean_Economy_Report_Web.pdf). 29. June 2009.

**Energy Efficiency:**

Includes efforts to reduce energy consumption in existing buildings and in industrial processes. It also includes efforts to improve new buildings' efficiency, to reduce energy lost in distributing electricity and to cultivate demand management (reducing the "peak demand"), because there's a higher possibility of pollution when the system is strained.

*Sample employers: civil engineering consultants and building construction contractors*

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**Renewable Energy:**

Includes the two new industries most commonly thought of as green: wind and solar power. This sector also includes geothermal energy and hydroelectric power.

*Sample employers: wind turbine builders and electric utility companies*

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**Clean Transportation:**

Includes public transit (rail, subways and others) and vehicle manufacturing (cars, planes and parts), increasing portions of which will use fuels other than fossil fuels, or use them more efficiently.

*Sample employers: aircraft manufacturers and transportation management companies*

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**Pollution Prevention & Environmental Cleanup:**

Includes efforts to restore polluted land and rivers to health, and clean industrial processes that lower toxins during production. Maintenance of water and sewer infrastructure to reduce pollution and eliminating contaminants from water are also in this category.

*Sample employers: scientific research facilities and water treatment plant builders*

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**Agriculture & Resource Conservation:**

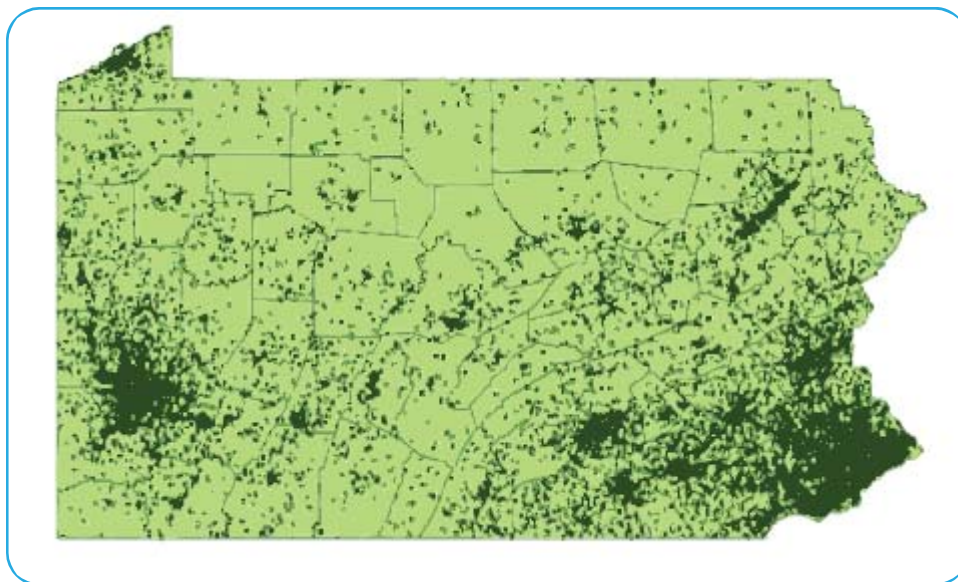
Includes production of renewable fuels (wood, other crops), effective management of natural resources, and practices such as conservation tillage, sustainable and organic agriculture that maintains or enhances soil quality and minimizes inputs.

*Sample employers: corn farms and energy consulting companies*

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Green industries are located throughout Pennsylvania (Figure 1). Additional maps showing employers by emerging sectors are in Appendix A.

**Figure 1.** Potential Green Employers in Pennsylvania



*Source: Center for Workforce Information & Analysis, October 2009*

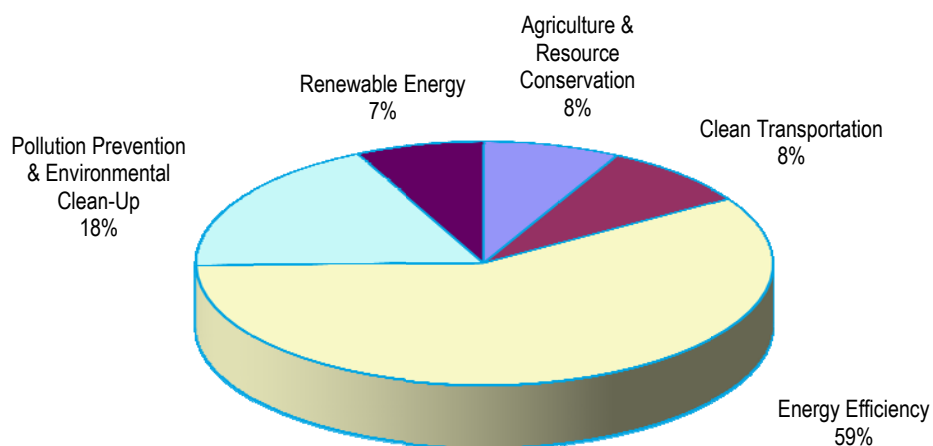
As shown by Table 1, there are approximately 350,000 jobs across all five of the identified green sectors. The largest (59 percent) is Energy Efficiency (Figure 2), with almost 206,000 jobs and more than 21,800 establishments. Pollution Prevention & Environmental Cleanup is second (18 percent) with more than 63,000 workers and approximately 2,600 establishments. And, while it employs the fewest people, Clean Transportation does have the highest number of workers per establishment, averaging 40 employees at each location.

**Table 1.** Number of Establishments and Employment Volume by Sector (2008)

Green Sector	Count of Establishments	Employment
Agriculture & Resource Conservation	2,731	26,792
Clean Transportation	726	29,492
Energy Efficiency	21,827	205,557
Pollution Prevention & Environmental Cleanup	2,587	63,358
Renewable Energy	765	25,303
<b>Total</b>	<b>28,636</b>	<b>350,502</b>

*Source: Center for Workforce Information & Analysis*

**Figure 2. Green Employment by Sector (2008)**



*Source: Center for Workforce Information & Analysis*

The occupations within each of these emerging sectors vary. Not every job is what most would view as a “green” occupation. Clerical, sales and other administrative positions provide support in these emerging industries, but do not necessarily have job content different than the same occupations in other industries; however, many of the traditional occupations in the emerging green sectors – from lawyers to construction workers – require new skill sets. As the commonwealth prepares to harness the potential of these growing sectors, training and education must be adapted to address the evolving nature of the work.



# The Pennsylvania **Green** Jobs Report | Section 2

## | **Green** Policies & Investments

Pennsylvania is a leader in stimulating growth in our emerging green sectors. New investments in alternative energy sources, aggressive energy efficiency strategies, investments in new technologies and replacement of water and sewer infrastructure all work to reduce energy consumption, break our reliance on foreign energy suppliers and create a cleaner environment for future generations. These strategies also create jobs.

This section provides some background on a number of initiatives that are helping make Pennsylvania industry greener and more competitive. Additionally, Table 2 (page 10) shows the estimates for the total amount of public- and private-sector investment over the 2010- 2012 period resulting from these state and federal policies.

**Pennsylvania's Alternative Energy Portfolio Standards (AEPS) Act (Act 213)** requires electricity suppliers to provide gradually increasing amounts of their energy from alternative energy sources – up to a total of 18 percent by 2020. AEPS also requires that solar energy, specifically, supply 0.5 percent of Pennsylvania's electricity by 2020. The level of alternative energy required gradually increases according to a 15-year schedule (starting in 2005 through 2020) found in Act 213.

AEPS is moving Pennsylvania's solar market toward \$1 billion per year, and in 2008, investment in wind alone was about \$400 million. This level is expected to continue. An additional \$170 million per year is expected in private-sector investments in other renewable sectors. Given these assumptions for the various renewable energy sub-clusters, \$1.57 billion will be annually invested in renewable energy due to AEPS, or \$4.71 billion over three years (as shown in Table 2).

**The Alternative Energy Investment Fund**, or AEIF, creates a \$650 million fund. The fund includes \$180 million to stimulate the growth of solar energy, \$190 million for other alternative energy projects, \$25 million to subsidize energy-efficient green buildings, \$40 million for early-stage activities in green business development, \$40 million to help low-income customers manage high energy prices, \$25 million for pollution-control and technology projects, \$50 million in tax credits for alternative-energy production and nearly \$100 million for subsidizing energy conservation for homeowners, small businesses and low-income families.<sup>2</sup>

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<sup>2</sup> Table 2 assumes total investments occur in equal installments over five years, which means \$390 million will occur in three years.

**Act 129** requires electric utilities with 100,000 or more customers to achieve a 1-percent reduction in electricity consumption by May 31, 2011, a 3-percent reduction in consumption by May 31, 2013 as well as a 4.5-percent reduction in peak demand. Utilities are projected to spend \$240 million per year, or \$720 million over three years, to reach these efficiency targets. Each dollar of utility investment is projected to leverage approximately three dollars in additional private investment, translating into nearly \$1 billion dollars annually as a result of Act 129 implementation.

**The American Recovery and Reinvestment Act (ARRA)** will provide Pennsylvania with \$252.8 million for the Weatherization Assistance Program, which will pay for the weatherization of nearly 30,000 low-income housing units over the next two to three years.

**Other ARRA funding** will support renewable energy and energy efficiency efforts likely to drive near-term job creation. Those efforts include:

- Pennsylvania State Energy Program – \$99.6 million in funding for wind, solar and clean biogas programs;
- Energy Efficiency and Conservation Block Grant – \$102.5 million in funding for local governments to increase their energy efficiency;
- Energy Efficiency Appliance Rebate Program – approximately \$9 million for the purchase of Energy Star appliances;
- Smart Grid Resiliency Program – \$1 million to ensure the resiliency of the country’s electrical grid; and
- Other Grants – provide opportunities for Pennsylvania to compete for grants for renewable energy and energy efficiency projects that could bring approximately \$800 million to the commonwealth.

**Federal Energy Tax Credits** include a 30-percent tax credit for the purchase of solar energy and fuel cells, as well as credits for wind, biomass, energy efficiency and refined coal investments.

### Water and Sewer Infrastructure Investment:

- H<sub>2</sub>O PA: \$800 million water and sewer fund for municipalities
- ARRA dollars for water and sewer infrastructure: \$220 million total
- PennVest dollars for water and sewer infrastructure — separate from the two previous sources: \$300 million annually

Assuming the H<sub>2</sub>O PA monies will be spent in equal allotments over six years (six years is the maximum length of a multiyear H<sub>2</sub>O PA grant), \$400 million will be spent in the first three years, \$220 million in ARRA dollars should all be used by the end of 2012 and \$300 million for PennVest annually adds up to \$900 million over three years. All three of these sources of water and sewer investment combine for a grand total over three years of \$1.52 billion.

**The Pennsylvania Community Transportation Initiative** will support 80 transportation projects that will create green jobs, relieve traffic congestion and make it easier for students to walk and bike to school.

**Biofuels Programs**, including the Alternative Fuels Investment Grant program, Pennsylvania Energy Harvest, First Industries Fund and the 2009 biomass-based diesel production incentive program, will invest between \$8 million to \$13 million annually from 2010 to 2012 to stimulate production of biofuels in the commonwealth's Agriculture & Resource Conservation sector.

## \$10 Billion in Green Investments

The combination of new energy policies and investments will lead to \$10 billion in public and private investments.

Table 2 shows the breakdown of public- and leveraged private-sector investment over three years by policy type.

Private-sector investment necessary to meet policy requirements, such as AEPS and Act 129, is included in these estimates.

**Table 2. Pennsylvania Policy-Driven Investment in the Green Economy**  
January 1, 2010 to December 31, 2012 (millions of dollars)

Green Sector	Advanced Energy Portfolio Standard	Alternative Energy Investment Fund	Energy Efficiency Mandates on Utilities (Act 129)	ARRA Weatherization Program	ARRA Energy & Energy Conservation Programs	State- and ARRA-Funded Water & Sewer Infrastructure	PA Community Transportation Initiative	Biofuels Programs	Total by Sector Across All Policy Drivers
Renewable Energy	\$4,710	\$240	\$11	—	\$500	—	—	—	\$5,461
Energy Efficiency	—	\$135	\$2,137	\$253	\$512	—	—	—	\$3,037
Pollution Prevention & Environmental Cleanup	—	\$15	—	—	—	\$1,520	—	—	\$1,535
Clean Transportation	—	—	—	—	—	—	\$76	—	\$76
Agriculture & Resource Conservation	—	—	—	—	—	—	—	\$32	\$32
<b>Total Across All Sectors</b>	<b>\$4,710</b>	<b>\$390</b>	<b>\$2,147</b>	<b>\$253</b>	<b>\$1,012</b>	<b>\$1,520</b>	<b>\$76</b>	<b>\$32</b>	<b>\$10,141</b>

*Source: Industry sources and input from the Pennsylvania Department of Environmental Protection*

Since this is a report intended to serve as a benchmark for job creation to inform future training and education policy, prior year investments are not counted. In addition, policies and programs on the horizon at the time this report was written have not been captured, but will be included in future reports.

## Projected Green Job Growth

Table 3 translates the \$10 billion in investments into estimated increases in jobs by year, from 2010 to 2012.

**Table 3.** Policy-Driven Jobs Resulting from Investment in Green Sectors  
2010 to 2012

Green Sector	Jobs by Year			
	2009-10	2010-11	2011-12	Total (2009-12)
Agriculture & Resource Conservation	247	209	152	608
Clean Transportation	418	418	-	836
Energy Efficiency	14,082	16,746	17,763	48,591
Pollution Prevention & Environmental Cleanup	9,210	9,210	9,210	27,630
Renewable Energy	11,290	12,869	14,065	38,224
<b>Total</b>	<b>35,247</b>	<b>39,452</b>	<b>41,190</b>	<b>115,889</b>

*Sources: Center for Workforce Information & Analysis based on industry and agency input regarding investment estimates each year in the specific green sectors. The IMPLAN model translates investments into employment projections.*

The IMPLAN model used to estimate job creation is an input/output model that estimates job creation based on total investment; therefore, job creation includes:

- Direct jobs, which include jobs at companies that produce or supply renewable energy, energy efficiency, clean transportation, and pollution prevention and environmental cleanup services (e.g. wind turbine manufacturer);
- Indirect jobs, which include jobs at companies that supply the green sector with goods and services (e.g. a manufacturer whose product is used in a wind turbine, but has other uses, too); and
- Induced jobs, which include jobs at companies across all sectors that directly benefit from the spending of those employed in direct and indirect jobs (e.g. grocery stores, restaurants, etc.).

Direct jobs account for slightly more than half the total in Table 3 — about 65,000 of the more than 115,000.

# The Pennsylvania **Green** Jobs Report | Section 3

## | **Green** Occupations

As Pennsylvania's green economy grows, workforce development and other policy makers must ask, "What are the new career opportunities, and what are the new training and education challenges presented by increased investment in the green economy?" In the previous section, this report focused on total job creation. This section looks at specific careers in each of the five green sectors, and identifies those with duties that are currently, or will most likely adapt to, promoting environmental well-being. While many occupations do not currently have responsibilities related to renewable energy, energy efficiency, or other green processes, they can – and likely will – grow greener as technology changes and demand increases.

The general consensus among local, state and federal researchers is that green jobs fall into three categories:

- **Emerging** – As a point of fact, it isn't that these jobs didn't exist at all, but that they are either new enough, or growing in number to such an extent, that current statistical job categories traditionally tracked by labor statisticians don't include them. Table 4 provides some emerging green occupations Pennsylvania has identified.
- **Evolving** – The majority of green jobs are in manufacturing and construction; however, many of them require new skills specific to the green sector. For example, construction workers skilled in commercial building may need new skills to become expert retrofitters.
- **Traditional** – These are occupations in green industries whose job duties are not changing significantly. Examples of these occupations include refuse & recyclable materials collectors and surveyors.

Table 4 provides examples of emerging, evolving and traditional careers. While they differ by green sector, all of them have an important contribution to make in the increasingly green economy.

**Table 4.** Examples of Emerging, Evolving & Traditional  
Green Occupations in Pennsylvania

Emerging Occupations	
Energy Auditors	Conduct energy audits of buildings, building systems and process systems. May also conduct investment-grade audits of buildings or systems.
Energy Engineers	Design, develop, and evaluate energy-related projects and programs to reduce energy costs or improve energy efficiency during the designing, building or remodeling stages of construction. May specialize in electrical systems; heating, ventilation and air-conditioning (HVAC) systems; green buildings; lighting; air quality or energy procurement.
Geothermal Installers	Perform technical activities at power plants or individual installations necessary for the generation of power from geothermal energy sources. Monitor and control operating activities at geothermal power generation facilities and perform maintenance and repairs as necessary. Install, test, and maintain residential and commercial geothermal heat pumps.
GIS Specialists	Work with related software and programs to create and maintain data and/or maps that can be combined with geographically referenced data. GIS software has the capacity to relate different types of data such as socioeconomic, demographic, administrative or political boundaries, land use, land cover, environmental, infrastructure and transportation networks.
Logistics Analysts	Analyze, forecast and report shipping/delivery data. May also assist with the development and optimization of logistic network planning models.
Mechatronics Engineers	Apply the latest techniques of interdisciplinary engineering fields – including precision mechanical engineering, controls theory, computer science and electronics – to design process that create more functional and adaptable products.
Mining & Geological Engineering Technicians	Inspect, validate, and approve the extraction of coal, metallic ores, nonmetallic minerals, and building materials, such as stone and gravel under the supervision of Mining Engineers. Ensure safety precautions, recommendations and proper techniques are being utilized.
Renewable Energy Technicians	Install, inspect, test, maintain or repair green power and renewable energy systems such as wind, solar or biomass systems.
Robotics Engineers	Design, test and build robots that are productive and safe to operate as well as economical to purchase and maintain. Engineers use computer-aided design and drafting, and computer-aided manufacturing (CADD/CAM) systems to perform their tasks.
Robotics Technicians	Assist engineers in all phases of robotic design, development, production, testing and operations. Technicians may be responsible for the initial installation of the robot as well as in-house maintenance or repair.
Solar Panel Installers	Assemble, install or maintain solar photovoltaic (PV) systems on roofs or other structures in compliance with site assessment and schematics. May include measuring, cutting, assembling and bolting structural framing and solar modules. May perform minor electrical work such as current checks.
Transportation Planners	Prepare studies for proposed transportation projects. Gather, compile and analyze data. Study the use and operation of transportation systems. Develop transportation models or simulations.
Water Treatment Operators	Utilize computers to help monitor equipment, store result samples, make process-control decisions, schedule and record maintenance activities, and produce reports in order to ensure that water is safe for the public to drink.
Weatherization Installers & Technicians	Perform a variety of activities to weatherize homes and make them more energy efficient. Duties include repairing windows, insulating ducts, and performing heating, ventilating and air-conditioning (HVAC) work. May perform energy audits and advise clients on energy conservation measures.
Wind Technicians	Maintain and repair wind turbines that are used to make energy.

Sample Evolving Occupations	
Agricultural & Food Science Technicians	Work with agricultural scientists in food, fiber, and animal research, production, and processing; assist with animal breeding and nutrition work; under supervision, conduct tests and experiments to improve yield and quality of crops or to increase the resistance of plants and animals to disease or insects.
Architects	Plan and design structures, such as private residences, office buildings, theaters, factories, and other structural property.
Carpenters	Construct, erect, install, or repair structures and fixtures made of wood, such as concrete forms; building frameworks, including partitions, joists, studding, and rafters; wood stairways, window and door frames, and hardwood floors.
Electricians	Install, maintain, and repair electrical wiring, equipment, and fixtures.
Environmental Engineering Technicians	Apply theory and principles of environmental engineering to modify, test, and operate equipment and devices used in the prevention, control, and remediation of environmental pollution, including waste treatment and site remediation.
Heating, Air Conditioning, & Refrigeration Mechanics & Installers	Install or repair heating, central air conditioning, or refrigeration systems, including oil burners, hot-air furnaces, and heating stoves.
Industrial Machinery Mechanics	Repair, install, adjust, or maintain industrial production and processing machinery or refinery and pipeline distribution systems.
Sample Traditional Occupations	
Construction Laborers	Perform tasks involving physical labor at building, highway, and heavy construction projects, tunnel and shaft excavations, and demolition sites.
Foresters	Manage forested lands for economic, recreational, and conservation purposes.
Machinists	Set up and operate a variety of machine tools to produce precision parts and instruments.
Plumbers, Pipefitters, & Steamfitters	Assemble, install, alter, and repair pipelines or pipe systems that carry water, steam, air, or other liquids or gases.
Refuse & Recyclable Material Collectors	Collect and dump refuse or recyclable materials from containers into truck.
Surveyors	Make exact measurements and determine property boundaries. Provide relevant data for engineering, mapmaking, mining, land evaluation, construction, and other purposes.
Welders, Cutters, Solderers, & Brazers	Use hand-welding, flame-cutting, hand soldering, or brazing equipment to weld or join metal components or to fill holes, indentations, or seams of fabricated metal products.
<i>Source: Center for Workforce Information &amp; Analysis</i>	



To determine green occupations, the Pennsylvania Department of Labor & Industry reviewed the more than 800 occupations in the current Standard Occupational Classification, or SOC, structure, applied the state's definition of green jobs, and identified 81 that are most closely linked to green services or processes (Appendix B). These occupations are found in one or more of the green sectors identified in this report.

Initial research does shed light on some clear characteristics of 81 green occupations:

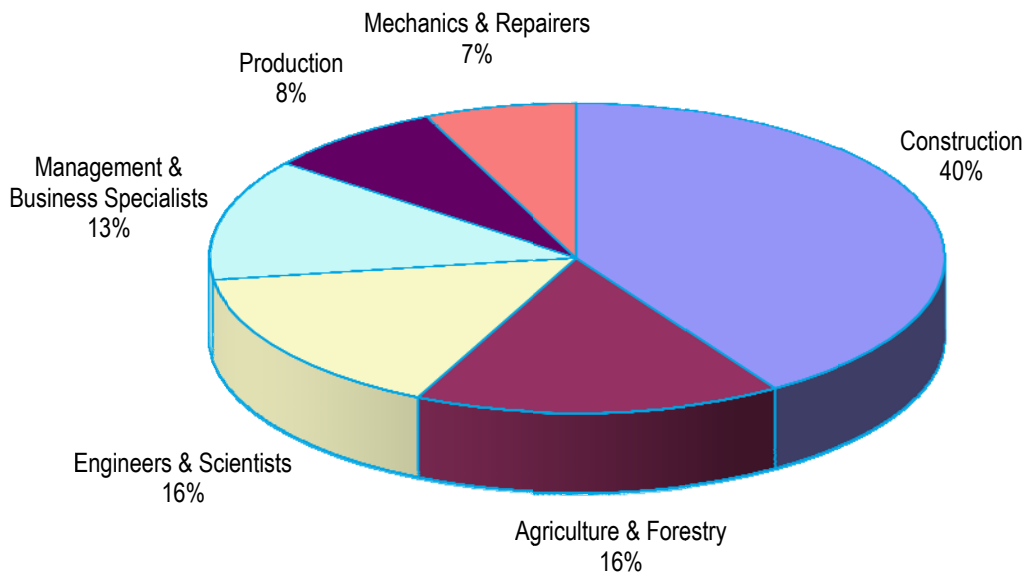
- Many of the state's green occupations are mid-range technical jobs requiring some education beyond high school and/or a technical credential;
- Green occupations generally pay well, are projected to grow, and many are already targeted for workforce investments; and
- Targeted workforce training in emerging green occupations, such as energy auditors, solar panel installers, water treatment plant operators and weatherization installers & technicians, is a good investment from both a job seeker and employer perspective – a dual focus that Pennsylvania adopted in 2003 with *Job Ready Pennsylvania*.

While many of the workers in these 81 green occupations may not be performing green work at this time or may not be performing it full time, many will be able to build on their existing skill sets and transition into the green economy with minimal training.

Figure 3 shows how employment in these 81 green occupations is distributed across all five green sectors, based on broad occupational groupings from the existing classification structure.

- Two out of every five workers are construction-related, primarily carpenters, construction laborers and electricians.
- Farmworkers represent the largest occupation in the Agriculture & Forestry group, which employs 16 percent of green occupational employment.
- Another 16 percent fall in the Engineers & Scientists group, many of which are designing and testing the products and processes that drive the green economy.

**Figure 3. Green Employment by Occupation Group (2006)**



Source: Center for Workforce Information & Analysis

To effectively target workforce training investments, Pennsylvania has identified High Priority Occupations, or HPOs, that are in demand by employers and pay a family-sustaining wage. Table 5 highlights green High Priority Occupations. It should be noted that many of the identified 81 green occupations are likely to be added in the future as HPOs. This and future reports are intended to provide estimates of industry demand in these fields.

**Table 5. State and Regional Green High Priority Occupations: An Initial List**

SOC Code	SOC Title	2008 Average Annual Wage	Educational Level	Primary Green Sector
47-2031	Carpenters	\$42,660	On-the-Job Training	Energy Efficiency
19-2031	Chemists	\$69,980	Bachelor's Degree	Pollution Prevention & Environmental Cleanup
17-2051	Civil Engineers	\$73,310	Bachelor's Degree	Energy Efficiency
47-2061	Construction Laborers	\$33,260	On-the-Job Training	Energy Efficiency
51-2022	Electrical & Electronic Equipment Assemblers	\$29,790	On-the-Job Training	Energy Efficiency
49-9051	Electrical Power-Line Installers & Repairers	\$59,050	On-the-Job Training	Renewable Energy
47-2111	Electricians	\$54,490	On-the-Job Training	Energy Efficiency

SOC Code	SOC Title	2008 Average Annual Wage	Educational Level	Primary Green Sector
13-1051	Energy Auditors*	N/A	On-the-Job Training	Energy Efficiency
17-2199	Energy Engineers*	N/A	Bachelor's Degree	Energy Efficiency
17-2081	Environmental Engineers	\$82,600	Bachelor's Degree	Energy Efficiency
49-9021	Geothermal Installers*	N/A	On-the-Job Training	Renewable Energy
49-9021	Heating, Air Conditioning & Refrigeration Mechanics & Installers	\$41,800	On-the-Job Training	Energy Efficiency
17-3026	Industrial Engineering Technicians	\$51,570	Associate Degree	Clean Transportation
17-2112	Industrial Engineers	\$73,180	Bachelor's Degree	Pollution Prevention & Environmental Cleanup
49-9041	Industrial Machinery Mechanics	\$43,150	On-the-Job Training	Renewable Energy
51-9061	Inspectors, Testers, Sorters, Samplers & Weighers	\$35,050	On-the-Job Training	Energy Efficiency
51-4041	Machinists	\$37,280	On-the-Job Training	Clean Transportation
49-9042	Maintenance & Repair Workers, General	\$35,320	On-the-Job Training	Energy Efficiency
13-1111	Management Analysts	\$85,550	Bachelor's Degree Plus	Energy Efficiency
47-2152	Plumbers, Pipefitters & Steamfitters	\$53,550	On-the-Job Training	Energy Efficiency
53-7081	Refuse & Recyclable Material Collectors	\$32,110	On-the-Job Training	Pollution Prevention & Environmental Cleanup
49-9099	Renewable Energy Technicians*	N/A	On-the-Job Training	Renewable Energy
47-2181	Roofers	\$39,790	On-the-Job Training	Energy Efficiency
49-9021	Solar Panel Installers*	N/A	On-the-Job Training	Renewable Energy
47-1011	Supervisors/Managers - Construction & Extraction Workers	\$62,650	Work Experience	Energy Efficiency
51-1011	Supervisors/Managers - Production Workers	\$54,460	Work Experience	Energy Efficiency
51-8031	Water & Liquid Waste Treatment Operators	\$41,340	On-the-Job Training	Pollution Prevention & Environmental Cleanup
49-1011	Weatherization Crew Leaders*	N/A	On-the-Job Training	Energy Efficiency
49-9042	Weatherization Installers*	N/A	On-the-Job Training	Energy Efficiency
51-4121	Welders, Cutters, Solderers & Brazers	\$34,840	Postsecondary Award	Energy Efficiency
<p><i>High Priority Occupations are those targeted by the commonwealth for workforce investment training monies because they are in-demand by employers, pay a family-sustaining wage and have higher skill requirements. Although the titles listed above are traditional occupations, many of the job duties performed by workers are expected to evolve as a direct result of investments in the five green sectors.</i></p> <p><i>* Educational attainment and selected SOC codes for these occupations are based on research done for this report.</i></p> <p><i>Source: Center for Workforce Information &amp; Analysis</i></p>				

## **An Opportunity for Growth: Weatherization**

The Department of Labor & Industry, in partnership with the Pennsylvania Department of Community and Economic Development, or DCED, collected – from employers and other sources – information about employment and training needs in the weatherization industry. DCED surveyed 43 Pennsylvania weatherization assistance providers to gain a better understanding of their current employee and subcontractor training needs. Using that information, the Department of Labor & Industry and DCED were able to determine how many training providers would be necessary to meet a statewide demand for certified weatherization professionals.

A statewide certification program provides important benefits:

- Employers working to meet Act 129 energy-efficiency requirements will know that prospective hires will have the skill and training they need;
- Certified installers, crew chiefs and auditors will perform at a consistent, high-quality standard everywhere in Pennsylvania;
- The ability to identify where, geographically, there is a need for certified weatherization professionals; and
- The ability to identify where there are people who will benefit from weatherization training.

Six grant recipients will provide weatherization training to students learning to become weatherization installers, crew chiefs and auditors. Additionally, Penn College of Technology – which developed the statewide weatherization training curriculum – will provide technical assistance to the training providers. Other grants will help create an apprenticeship model. All training providers will help Pennsylvania identify, train and certify more than 1,000 workers to complete high-quality energy reduction, conservation and weatherization activities in approximately 30,000 single- and multi-family homes across the state.

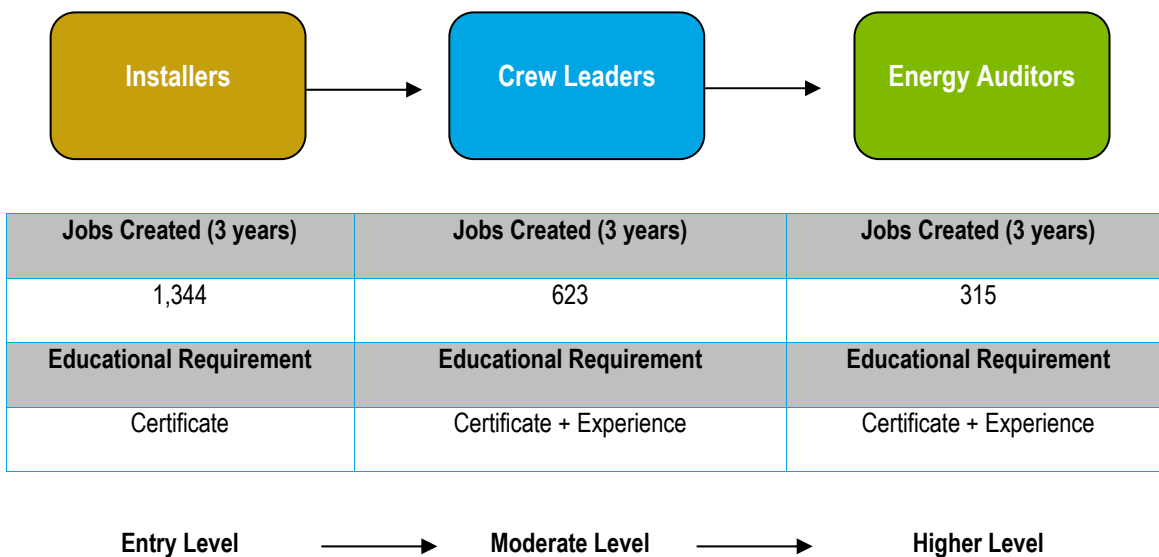
In the past, weatherization workers were not required to be certified. Under the Pennsylvania Weatherization Program, workers receive an installer, crew chief or auditor certificate upon the satisfactory completion of a state-certified training course. The Department of Labor & Industry is working with weatherization training providers and industry employers to tie this training to other fields – especially green practices in building and construction.

## Career Paths in the Green Economy

Pennsylvania's workforce strategy, based on connecting training to industry needs, has a dual purpose: boosting competitiveness and expanding opportunity. Because so many green occupations are emerging or evolving from traditional occupations, Pennsylvanians may not be aware of the opportunities in the green sectors or the career pathways into these occupations.

Figure 4 illustrates a potential career path in weatherization – an emerging field with an immediate need for workers as a result of recent federal and state investments, and the requirements of electricity providers to lower consumer usage.

**Figure 4.** Sample Career Progression: Weatherization



# The Pennsylvania Green Jobs Report | Section 4

## | Industry Leads the Way

Under Governor Rendell, Pennsylvania has become a nationally recognized leader in industry-led workforce development. Before he took office, Pennsylvania workforce development, like most states, was primarily job matching: career centers making temporary connections between employers and job seekers. Among a host of this approach's shortcomings: limited training, short-term employment, inadequate wages and an absence of career development opportunities. While immediate employment needs were being met, employers' long-term workforce needs went unaddressed.

That's changed for good – and for the good of employers, job seekers and the commonwealth of Pennsylvania.

In 2003, Governor Rendell introduced *Job Ready Pennsylvania*, a collection of innovative workforce development initiatives that improved the connection between employers and the workforce by using industry information about training needs, skill gaps and more to determine and guide workforce policy and investment. By working much more closely with employers to understand their specific needs, and by working much more closely with schools and training providers to deliver targeted instruction and workforce training to job seekers, Pennsylvania is now connecting relevantly skilled workers with employers' career-focused occupations that pay a family-sustaining wage.

This industry-driven workforce development strategy is ideally suited to respond to emerging green industries' needs. It uses a three-pronged approach:

- **Targeted Industry Clusters** have been identified by the Pennsylvania Department of Labor & Industry as industries with good jobs and in which the state has a competitive advantage.
- **High Priority Occupations** are those occupations in targeted industry clusters that are in demand by employers, pay family-sustaining wages and offer opportunities for career advancement.
- **Industry Partnerships** are defined as groups of employers, from targeted industry clusters, working together to identify and address their common workforce needs. In addition to the partnerships themselves, local workforce investment boards are all well positioned to help employers extend their reach into green markets.

Pennsylvania already has eight industry partnerships focused on delivering advanced training that meets green employers' needs (Table 6). Other partnerships – in building and construction, and manufacturing – have the ability to make connections between employers and expanding green industry markets, such as energy-efficient buildings or environmentally responsible products.

<b>Table 6. Green Training Through PA Industry Partnerships</b>				
<b>Cluster</b>	<b>Industry Partnership</b>	<b>Companies</b>	<b>Trainees</b>	<b>Sample Trainings</b>
Advanced Manufacturing	Central PA Advanced Manufacturing	34	49	Strategic Energy Planning; Energy Efficient Lighting; Motor Systems Management
	Tri-County Manufacturing Consortia	25	35	Building Products for the Green Market; Overview of Evaluating Green in Industry and Manufacturing
Building & Construction	Central PA Building & Construction/Factory Build Housing	34	92	Green Advantage Commercial Construction Certification; Residential Energy Services Network Field Inspector Rater Course; Building Science for Modular Construction
	Northwest PA Building Trades	7	26	Green Advantage Certification; Green Advantage Building Training
Energy	Smart Energy Initiative	112	143	Basic Grid-Tier Solar Photovoltaic; Advanced Solar Photovoltaic Design/Installation; Green Advantage Certification; RESNET (Residential Energy Services Network); Building Performance Institute
	Three Rivers Clean Energy	33	222	Energy Conservation and Facility Retrocommissioning; Green Awareness; SolidWorks; Radiation Training
	Keystone Utilities	TBD	TBD	Beck Drive Training; Duquesne Light Stimulus Team; IBEW Local 712 Green Training Initiative
Plastics	Northwest Plastics	4	138	Lean Manufacturing

*Source: Pennsylvania Local Workforce Investment Boards*

## Examples of Local Workforce Investment Boards' Green Activities

The Lancaster County Workforce Investment Board is working on three green-industry projects. They are:

- Development of a Building Energy Technology Program in collaboration with Thaddeus Stevens College of Technology. The curriculum consists of six courses: Green Building Energy Systems; Technical Aspects of Renewable and Alternative Energy; Residential Building Energy and Environmental Systems; Home Performance Energy Evaluations; Commercial, Industrial Building Energy and Environmental Systems; and Building System Maintenance. The first class included 25 participants from 18 companies.
- Staffing of the Lancaster County Center of Excellence in Renewable Energy ([www.LancasterCountyRenewableEnergy.com](http://www.LancasterCountyRenewableEnergy.com)) which is a project of Lancaster Prospers, a local economic development collaborative. The center coordinates all energy training activities taking place in the region. Partners include the Smart Energy Initiative from Chester County, Thaddeus Stevens College and the Lancaster County Career and Technology Center. A December 2008 one-day training event, offered by the center and called "Energy on the Farm," drew nearly 200 people.
- Advertising green opportunities, in conjunction with other local planning, economic and industry groups, through eye-catching brochures highlighting job duties, skills required, education and certificates needed. Examples of occupations being marketed are:
  - Building Control Systems Technicians
  - Solar PV Installers
  - Geothermal Technicians
  - Energy Regulation Specialists

Several local workforce investment boards in southwestern Pennsylvania are also marketing green occupations through their PA CareerLink® offices. The consortium of local workforce investment boards developed a *Clean Tech Resource Manual* that profiles more than 90 occupations tied to the energy industry. Included in the profiles are an occupational overview, employment and wage data, educational requirements and related occupations. Examples of occupations included in the manual are:

- Pump Operators
- Electrical Engineering Technicians
- Landscape Architects
- Plumbers, Pipe Fitters and Steam Fitters



## | Green Pathways Out of Poverty

Pennsylvania is also working with industry partnership employers and private philanthropy to create career paths, accessible to low-income workers, to help them climb out of poverty. Working with organizations such as Pittsburgh's Heinz Endowments, the Harrisburg-based Foundation for Enhancing Communities and the Berks County Foundation in Reading, green Pathways Out of Poverty projects are already in happening in southwestern, southeastern, south central and northwestern Pennsylvania.

### Building Green Pathways Out of Poverty

*Southeast Pennsylvania* – The Smart Energy Initiative is working with electric utilities in Philadelphia and south central Pennsylvania to encourage energy efficiency companies to design workforce services that meet the industry's need for additional energy efficiency workers. This basic approach, with utilities encouraging their energy efficiency companies to collaborate with a local industry partnership, makes sense for all seven utilities faced with meeting state electricity conservation mandates.

*Southwest Pennsylvania* – A new labor-management clearinghouse has been established, with foundation and state support, to create new green pathways out of poverty. The initiative builds on prior industry partnership efforts in three sectors: construction, utilities and energy. An effort is also under way to add weatherization as a career entry point, with promotion possibilities into construction, utilities or the fast-growing private energy efficiency market.

# The Pennsylvania Green Jobs Report | Section 5

## | Next Steps in Research

Pennsylvania is poised to embrace the economic and workforce development potential in the greening of the state's economy. The Department of Labor & Industry, as the state's principal workforce policy organization, is uniquely positioned to aid in this effort.

With green jobs now defined, the commonwealth's workforce system needs to better understand the nature and magnitude of these jobs in the state's economy. There is a need for a formal system to collect, analyze and disseminate green labor market information, and to develop a labor exchange infrastructure to direct job seekers to careers in green industry sectors such as energy efficiency and renewable energy. Understanding what skills are sought by employers in the green economy, in both entry-level and professional-level workers, is crucial. Through asset-mapping of our existing framework of educational programs, we can better determine if we are producing trained workers with these skills in sufficient quantity; or, if we have sufficient workers, how the workforce system can aid in retooling the existing skill sets of today's workers for tomorrow's opportunities. We also need industry to validate industry-recognized certifications that are relevant in the green economy.

On Nov. 18, 2009 Pennsylvania received a \$1.25 million competitive Labor Market Information Grant, through the American Recovery and Reinvestment Act, to help develop green labor market information for Pennsylvanians. Considerably aided by this Recovery Act grant, the Pennsylvania Department of Labor & Industry will undertake several activities, in coordination with other state agencies, Local Workforce Investment Boards, Industry Partnerships and employers to enhance its labor market infrastructure and gather information about this emerging economy, including:

- (1) Economy-wide employer surveys — to estimate current and anticipated green jobs, critical occupations, unique skill needs and potential skill shortages;
- (2) Employer focus groups and training needs surveys to augment traditional labor-market tools and more precisely define employers' training needs;
- (3) Inventory of green education and training capacity drawing on the knowledge of Industry Partnerships and Local Workforce Investment Boards;
- (4) Job task analyses of emerging and "evolving" green occupations that enable customization of green curricula and assessment tools; and
- (5) Creation of an automated career tool (with information on wages, career paths and education/certification requirements) to market green jobs to job seekers.

Attention will be given to information gathered from Industry Partnerships and Local Workforce Investment Boards to help determine local training priorities. Part 2 of *The Pennsylvania Green Jobs Report* will analyze the green economy based on the results of a statewide employer survey, and will be targeted to workforce development practitioners and educators to help them prepare businesses and job seekers for green opportunities. It will identify green competencies for green occupational groups and concentrate on potential green career pathways.

Without a doubt, Pennsylvania is at the threshold of an incredible opportunity to capitalize on the trends and investments in the green economy. With the commonwealth's established workforce development programs, and the potential for growth across the five green sectors, Pennsylvania is positioned to become a national leader in creating and fostering green economy jobs.

| **Appendix A: Locations of Employers by **Green** Sector**

| **Appendix B: **Green** Occupations**

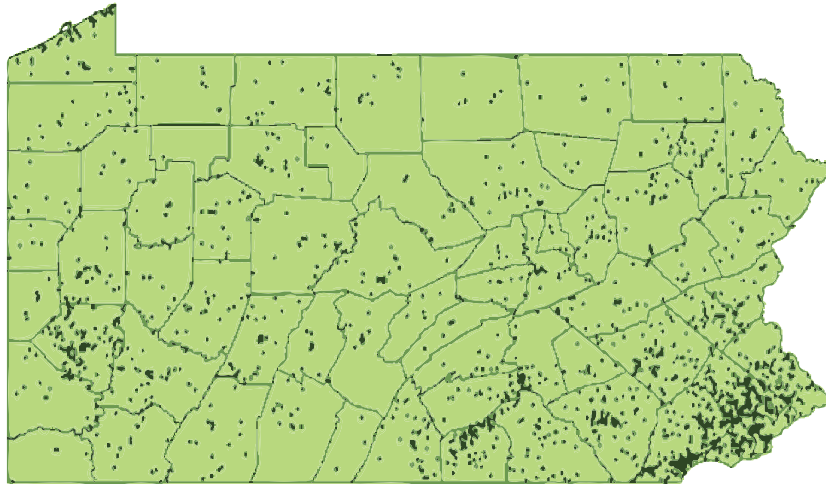
| **Appendix C: Methodology**

| **Appendix D: NAICS Industries within Pennsylvania's Five **Green** Sectors**

## Appendix A

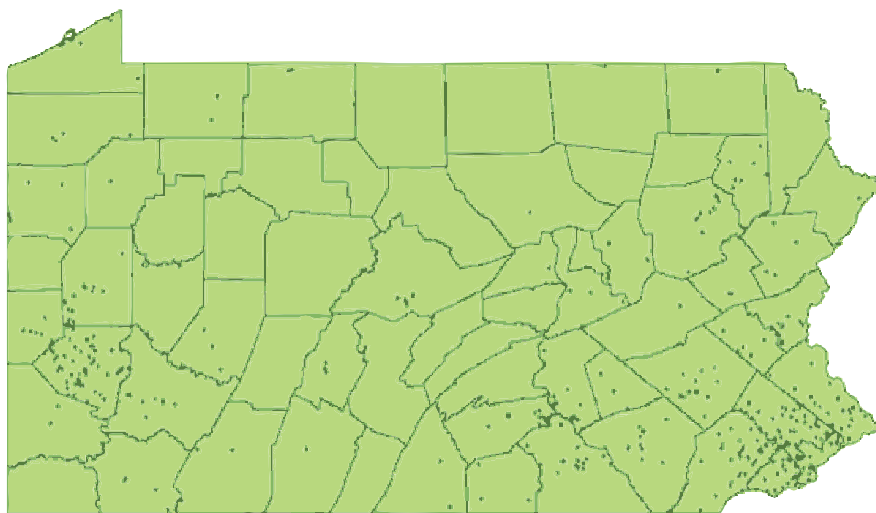
### Locations of Employers by Green Sector

Potential Green Employers in Pennsylvania Agriculture & Resource Conservation



Center for Workforce Information & Analysis, October 2009

Potential Green Employers in Pennsylvania Clean Transportation



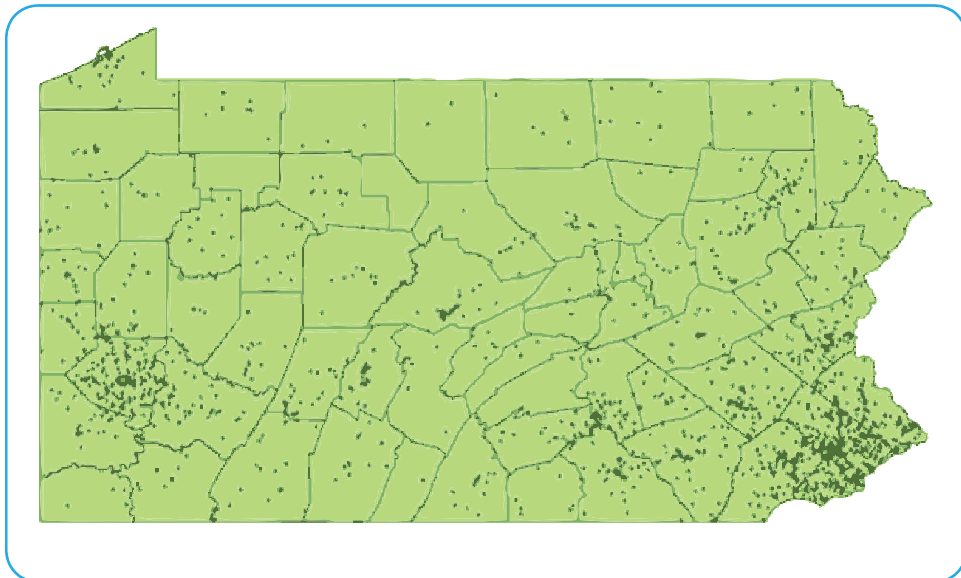
Center for Workforce Information & Analysis, October 2009

### Potential **Green** Employers in Pennsylvania Energy Efficiency



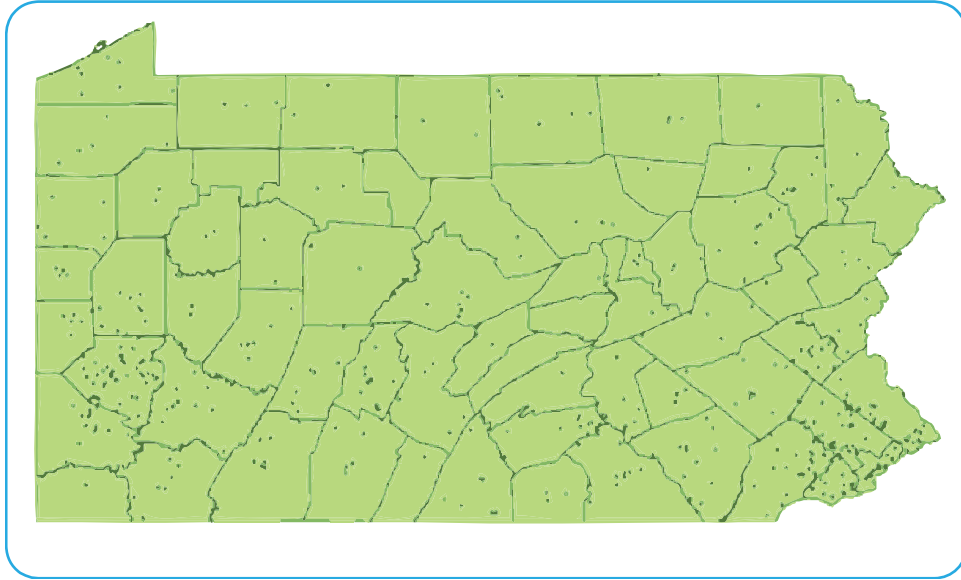
Center for Workforce Information & Analysis, October 2009

### Potential **Green** Employers in Pennsylvania Pollution Prevention & Environmental Cleanup



Center for Workforce Information & Analysis, October 2009

### Potential **Green** Employers in Pennsylvania Renewable Energy



Center for Workforce Information & Analysis, October 2009

## Appendix B

Green Occupations						
SOC Code	SOC Title	2006 Estimated Employment	Estimated % Growth 2006-2016	2008 Average Annual Wage	Educational Level	2009 PA HPO
11-3051	Industrial Production Managers	6,310	-1.27%	\$83,230	Bachelor's Degree	
11-3071	Transportation, Storage & Distribution Managers	3,330	12.31%	\$88,060	Work Experience	
11-9011	Farm, Ranch & Other Agricultural Managers	12,770	11.12%	\$74,080	Bachelor's Degree +	
11-9012	Farmers & Ranchers	33,920	2.33%	N/A	Long-Term OJT	
11-9021	Construction Managers	9,720	9.26%	\$91,710	Bachelor's Degree	
11-9041	Engineering Managers	5,560	2.34%	\$112,050	Bachelor's Degree +	
11-9121	Natural Sciences Managers	1,320	13.64%	\$157,710	Bachelor's Degree +	
13-1111	Management Analysts	24,930	20.18%	\$85,550	Bachelor's Degree +	HPO
17-1011	Architects	5,000	-0.20%	\$79,190	Bachelor's Degree	
17-1012	Landscape Architects	730	1.37%	\$60,720	Bachelor's Degree	
17-1021	Cartographers & Photogrammetrists	230	4.35%	\$42,900	Bachelor's Degree	
17-1022	Surveyors	2,130	4.23%	\$51,910	Bachelor's Degree	
17-2021	Agricultural Engineers	90	22.22%	\$65,310	Bachelor's Degree	
17-2041	Chemical Engineers	1,100	10.00%	\$79,070	Bachelor's Degree	
17-2051	Civil Engineers	10,870	4.32%	\$73,310	Bachelor's Degree	HPO
17-2071	Electrical Engineers	6,510	-0.61%	\$81,400	Bachelor's Degree	
17-2072	Electronics Engineers	5,500	10.36%	\$84,350	Bachelor's Degree	
17-2081	Environmental Engineers	2,600	24.62%	\$82,600	Bachelor's Degree	HPO
17-2112	Industrial Engineers	9,070	25.69%	\$73,180	Bachelor's Degree	HPO
17-2131	Materials Engineers	1,400	-2.86%	\$78,880	Bachelor's Degree	
17-2141	Mechanical Engineers	9,140	0.00%	\$74,640	Bachelor's Degree	
17-3022	Civil Engineering Technicians	2,790	-1.43%	\$41,050	Associate Degree	



SOC Code	SOC Title	2006 Estimated Employment	Estimated % Growth 2006-2016	2008 Average Annual Wage	Educational Level	2009 PA HPO
17-3023	Electrical & Electronic Engineering Technicians	7,000	-1.29%	\$49,750	Associate Degree	
17-3024	Electro-Mechanical Technicians	420	0.00%	\$39,910	Associate Degree	
17-3025	Environmental Engineering Technicians	1,540	16.23%	\$39,750	Associate Degree	
17-3026	Industrial Engineering Technicians	4,150	9.64%	\$51,570	Associate Degree	HPO
17-3027	Mechanical Engineering Technicians	2,080	1.44%	\$43,430	Associate Degree	
17-3031	Surveying & Mapping Technicians	1,710	1.75%	\$34,250	Moderate-Term OJT	
19-1013	Soil & Plant Scientists	220	4.55%	\$62,420	Bachelor's Degree	
19-1031	Conservation Scientists	710	7.04%	\$46,340	Bachelor's Degree	
19-1032	Foresters	490	8.16%	\$49,340	Bachelor's Degree	
19-2031	Chemists	5,030	6.36%	\$69,980	Bachelor's Degree	HPO
19-2032	Materials Scientists	620	8.06%	\$75,260	Bachelor's Degree	
19-2041	Environmental Scientists & Specialists	1,840	16.85%	\$66,020	Bachelor's Degree	
19-2042	Geoscientists	710	7.04%	\$69,870	Bachelor's Degree	
19-2043	Hydrologists	130	0.00%	\$81,250	Bachelor's Degree	
19-3051	Urban & Regional Planners	1,320	6.82%	\$46,550	Master's Degree	
19-4011	Agricultural & Food Science Technicians	590	0.00%	\$34,730	Associate Degree	
19-4031	Chemical Technicians	4,550	4.62%	\$43,060	Associate Degree	
19-4091	Environmental Science & Protection Technicians	1,450	13.10%	\$42,930	Associate Degree	
19-4093	Forest & Conservation Technicians	140	0.00%	\$36,030	Associate Degree	
25-9021	Farm & Home Management Advisors	1,410	-1.42%	N/A	Bachelor's Degree	
27-1021	Commercial & Industrial Designers	1,960	9.18%	\$50,720	Bachelor's Degree	
27-1025	Interior Designers	1,830	2.19%	\$45,290	Bachelor's Degree	
37-3011	Landscaping & Groundskeeping Workers	42,170	15.58%	\$25,860	Short-Term OJT	

SOC Code	SOC Title	2006 Estimated Employment	Estimated % Growth 2006-2016	2008 Average Annual Wage	Educational Level	2009 PA HPO
45-2092	Farmworkers & Laborers, Crop, Nursery & Greenhouse	30,670	7.47%	\$23,250	Long-Term OJT	
45-4011	Forest & Conservation Workers	500	8.00%	\$36,400	Moderate-Term OJT	
47-1011	Supervisors/Managers - Construction & Extraction Workers	19,520	2.92%	\$62,650	Work Experience	HPO
47-2031	Carpenters	60,420	3.19%	\$42,660	Long-Term OJT	HPO
47-2061	Construction Laborers	41,400	3.21%	\$33,260	Moderate-Term OJT	HPO
47-2111	Electricians	25,370	1.02%	\$54,490	Long-Term OJT	HPO
47-2121	Glaziers	1,530	0.00%	\$36,430	Long-Term OJT	
47-2131	Insulation Workers, Floor, Ceiling & Wall	650	1.54%	\$41,060	Moderate-Term OJT	
47-2132	Insulation Workers, Mechanical	500	0.00%	\$60,410	Moderate-Term OJT	
47-2152	Plumbers, Pipefitters & Steamfitters	16,200	1.67%	\$53,550	Long-Term OJT	HPO
47-2181	Roofers	5,280	4.36%	\$39,790	Moderate-Term OJT	HPO
47-4011	Construction & Building Inspectors	5,630	7.64%	\$45,300	Work Experience	
47-4041	Hazardous Materials Removal Workers	830	13.25%	\$41,900	Moderate-Term OJT	
49-1011	Supervisors/Managers - Mechanics, Installers & Repairers	15,440	2.07%	\$61,140	Work Experience	
49-2094	Electrical & Electronics Repairers, Commercial & Industrial Equipment	4,490	3.79%	\$46,460	Post-Secondary Vocational	
49-2095	Electrical & Electronics Repairers, Powerhouse, Substation & Relay	900	-15.56%	\$58,450	Post-Secondary Vocational	
49-9012	Control & Valve Installers & Repairers	1,030	-6.80%	\$44,950	Moderate-Term OJT	
49-9021	Heating, Air Conditioning & Refrigeration Mechanics & Installers	14,180	2.47%	\$41,800	Long-Term OJT	HPO
49-9041	Industrial Machinery Mechanics	16,680	14.57%	\$43,150	Long-Term OJT	HPO
49-9042	Maintenance & Repair Workers, General	66,390	3.84%	\$35,320	Long-Term OJT	HPO
49-9051	Electrical Power-Line Installers & Repairers	4,150	1.93%	\$59,050	Long-Term OJT	HPO

SOC Code	SOC Title	2006 Estimated Employment	Estimated % Growth 2006-2016	2008 Average Annual Wage	Educational Level	2009 PA HPO
51-1011	Supervisors/Managers - Production Workers	30,450	-2.04%	\$54,460	Work Experience	HPO
51-2022	Electrical & Electronic Equipment Assemblers	9,430	-22.69%	\$29,790	Short-Term OJT	HPO
51-2031	Engine & Other Machine Assemblers	1,030	-5.83%	\$35,640	Short-Term OJT	
51-4041	Machinists	21,300	9.95%	\$37,280	Long-Term OJT	HPO
51-4121	Welders, Cutters, Solderers & Brazers	18,400	6.20%	\$34,840	Post-Secondary Vocational	HPO
51-4193	Plating & Coating Machine Setters, Operators & Tenders	2,580	4.65%	\$31,990	Moderate-Term OJT	
51-8012	Power Distributors & Dispatchers	470	-17.02%	\$69,500	Long-Term OJT	
51-8013	Power Plant Operators	2,070	-8.21%	\$55,540	Long-Term OJT	
51-8021	Stationary Engineers & Boiler Operators	1,590	1.89%	\$46,010	Long-Term OJT	
51-8091	Chemical Plant & System Operators	2,000	-0.50%	\$50,450	Long-Term OJT	
51-9011	Chemical Equipment Operators & Tenders	4,370	2.75%	\$43,680	Moderate-Term OJT	
51-9061	Inspectors, Testers, Sorters, Samplers & Weighers	23,970	-5.09%	\$35,050	Moderate-Term OJT	HPO
51-9141	Semiconductor Processors	420	0.00%	\$34,170	Associate Degree	
53-7072	Pump Operators	340	-5.88%	\$35,580	Moderate-Term OJT	
53-7081	Refuse & Recyclable Material Collectors	5,550	-3.42%	\$32,110	Short-Term OJT	HPO

## Appendix C

### Methodology

**Defining Five Green Sectors of Economic Activity:** In order to estimate the green workforce in Pennsylvania, the Center for Workforce Information & Analysis evaluated numerous reports, including recent reports from Pew Charitable Trusts and Global Insight, and collaborated with other state agencies and experts in the field. To identify green industries, each six-digit North American Industry Classification System (NAICS) code was reviewed to see if the products, services or processes captured in that NAICS code aligned with the following guiding definition for green employment:

*Workers directly involved in the efficient use and conservation of traditional fuels or alternative energy or energy efficient technologies — limited to construction, inspection, research, regulation, distribution, supply and manufacturing processes.*

If so, the specific industry, and corresponding NAICS code, was included. These NAICS codes were further grouped into the five broad sectors described in the body of this report (see Appendix D for more detail).

**Defining Green Occupations:** Occupations are classified by their own unique coding structure – the Standard Occupational Classification system. As with the NAICS system, the Standard Occupational Classification structure is somewhat dated and designed to group together individuals who perform similar sets of tasks. As such, many of the green jobs of today and tomorrow (and their corresponding labels) do not have their own unique Standard Occupational Classification code at this time. Instead, these workers are grouped with others doing similar work but using traditional processes or products. This limits the availability of occupation-specific data for green jobs.

Given the limitations described in the previous paragraph, a staffing pattern, or occupational employment distribution by Standard Occupational Classification code, was developed for each NAICS code identified as green. Individual industry staffing patterns were then combined to estimate an overall staffing pattern for all green industries. CWIA identified 81 Standard Occupational Classification codes connected prominently to the overall guiding definition for green employment (see Appendix B for the full list).

**Defining Investment in the Green Sectors:** Pennsylvania's investment in the five green sectors was based on input from the Department of Environmental Protection, other agencies and industry experts (with the exception of the information presented in Table 3, which, due to state and federal policies, was estimated by the Center for Workforce Information & Analysis).

**Estimating Total Output and Job Creation Due to Green Investment:** Annualized projections of investment by green sector were converted to estimates of total output and job creation using the IMPLAN model. IMPLAN is an economic analysis system that analyzes inter-industry supply chains and linkages at the national, state and county level using input-output accounting. The system is designed to assess the effects of a real or hypothetical event in a region that increases or reduces economic activity in a region. In this case, the event is the stimulation of demand in green industries. Purchases for final use (final demand) drive the model. Industries produce goods and services for final demand, creating jobs and output. Industries serving final demand markets also purchase goods and services from other producers, leading to indirect job creation at their suppliers, and at the next tier of suppliers, and so on. The income that goes to workers and owners at each point in the supply chain also translates into so-called induced demand. These indirect and induced effects (the effects of household spending) can be mathematically derived. The resulting sets of multipliers describe the change of output for each and every regional industry caused by a \$1 change in final demand for any given industry.

To arrive at the Center for Workforce Information & Analysis' green jobs estimates, those IMPLAN industry sectors most closely aligning to the industries contained in each of the Center's five green sectors were selected and aggregated. This was done for each of the Center's five green sectors of economic activity. Once aggregated, an economic impact was created by investing \$1 million in each IMPLAN green industry sector. Based on the multipliers sets for each converted IMPLAN green industry sector resulting output and job creation estimates were produced. The Agriculture and Resource Conservation Green industry sector produced 19 jobs. The Pollution Prevention & Environmental Cleanup industry sector produced 18 jobs. The Energy Efficiency industry produced 16 jobs. The Clean Transportation industry produced 11 jobs and the Renewable Energy industry sector produced seven jobs.

## Appendix D

### NAICS Industries within Pennsylvania's Five Green Sectors

Below is a listing of six-digit North American Industry Classification System (NAICS) codes used by Pennsylvania to define the green economy and its five targeted sectors.

#### *Agriculture & Resource Conservation*

111000	Crop Production
113110	Timber Tract Operations
113210	Forest Nursery/Gathering Forest Products
113310	Logging
541320	Landscape Architectural Services
541360	Geophysical Surveying & Mapping Services
541370	Other Surveying & Mapping Services
541690	Other Technical Consulting Services
924120	Administration of Conservation Programs
925120	Urban & Rural Development Admin

#### *Energy Efficiency*

221330	Steam & Air-Conditioning Supply
236115	New Single-Family Housing Construction
236116	New Multifamily Housing Construction
236117	New Housing Operative Builders
236118	Residential Remodelers
236210	Industrial Building Construction
236220	Commercial Building Construction
238151	Residential Glass/Glazing Contractors
238152	Nonresidential Glass/Glazing Contractors
238161	Residential Roofing Contractors
238162	Nonresidential Roofing Contractors
238211	Residential Electrical Contractors
238212	Nonresidential Electrical Contractors
238221	Residential Plumbing/HVAC Contractors
238222	Nonresidential Plumbing/HVAC Contractors
333414	Heating Equipment
333415	AC, Refrig. & Forced Air Heating Mfg
334512	Automatic Environmental Control Mfg
334513	Industrial Process Variable Instruments
334514	Fluid Meters & Counting Devices
335110	Electric Lamp Bulb & Part Manufacturing
335221	Household Cooking Appliance Mfg
335222	Household Refrigerators & Freezers
335224	Household Laundry Equipment Mfg
335228	Other Major Household Appliance Mfg
335312	Motor & Generator Manufacturing
541310	Architectural Services
541330	Engineering Services
541350	Building Inspection Services
541410	Interior Design Services
541420	Industrial Design Services
926150	Licensing/Regulating Commercial Sectors

*Clean Transportation*

324110	Petroleum Refineries
324199	All Other Petroleum & Coal Products
336111	Automobile Manufacturing
336112	Light Truck & Utility Vehicle Mfg
336120	Heavy Duty Truck Manufacturing
336213	Motor Home Manufacturing
336312	Gasoline Engines & Engine Parts
336350	Motor Vehicle Power Train Components
336411	Aircraft Manufacturing
336412	Aircraft Engine & Engine Parts
336611	Ship Building & Repairing
336612	Boat Building
336991	Motorcycle, Bicycle & Parts Mfg
541614	Process & Logistics Consulting Services
926120	Transportation Program Administration

*Pollution Prevention & Environmental Cleanup*

237110	Water & Sewer System Construction
335911	Storage Battery Manufacturing
335999	Miscellaneous Electrical Equipment
541380	Testing Laboratories
541620	Environmental Consulting Services
541710	Physical/Engineering/Bio Research
562111	Solid Waste Collection
562119	Other Waste Collection
562212	Solid Waste Landfill
562213	Solid Waste Combustors & Incinerators
562219	Other Nonhazardous Waste Disposal
924110	Air, Water & Waste Program Admin

*Renewable Energy*

221111	Hydroelectric Power Generation
221119	Other Electric Power Generation
221121	Electric Bulk Power Transmission
221122	Electric Power Distribution
237130	Power/Communication System Construction
237990	Other Heavy Construction
325199	All Other Basic Organic Chemicals
333611	Turbine Generator & Generator Set Units
333911	Pump & Pumping Equipment Mfg
334413	Semiconductor & Related Devices
335311	Electric Power & Specialty Transformers
926130	Utility Regulation & Administration

*The Pennsylvania Green Jobs Report* explores the green economy and green jobs in relation to Pennsylvania's workforce and economic development efforts.

*The Pennsylvania Green Jobs Report – Part I* begins by assessing the current status of green jobs in the commonwealth and looking at the projected growth of those jobs as a result of state and federal policies and investments. The report explores green occupations in Pennsylvania, including: new occupations currently in creation, emerging occupations that are projected to grow, evolving occupations that will require new skills and traditional occupations. Finally, the report outlines the framework for Pennsylvania's green training priorities and identifies the next steps necessary to enhance its labor market infrastructure, identify the needs of employers and gather information on the emerging green economy moving forward.

The Pennsylvania **Green** Jobs Report – Part 1  
January 2010

**Commonwealth of Pennsylvania**

Edward G. Rendell, Governor

Sandi Vito, Secretary,  
Department of Labor & Industry

Fred Dedrick, Deputy Secretary for Workforce Development  
Department of Labor & Industry

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